IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	Johannes Kaeppeler
Application No. 10/751,390	Filing Date: January 5, 2004
Title of Application:	CVD Device with Substrate Holder with Differential Temperature Control
Confirmation No. 2672	Art Unit: 1763

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Appeal Brief Under 37 CFR §41.37

Dear Sir:

A Notice of Appeal from the rejection of claims 1 and 3-19, all pending claims of U.S. Patent Application No. 10/751,390, being filed herewith, Applicant accordingly files its Appeal Brief in connection with its appeal. A Claims Appendix is submitted herewith, as are Appendices related to evidence previously submitted and decisions related to the case.

Applicant believes that no further fees, other than the Appeal Brief fee in the amount of $500.00 and the Request For Oral Hearing fee in the amount of $1000.00, are due in connection with the filing of this Response. However, if any further fees are due please charge to Deposit Account No. 19-4516.

(i) Real Party In Interest

The real party in interest is Aixtron AG having an address of Kackertstrasse 15-17, D-52072 Aachen Germany assignee of the present patent application.

(ii) Related Appeals and Interferences

There are no related appeals, interferences or judicial proceedings known to Appellant, the Appellant's legal representative, or Assignee which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(iii) Status Of Claims

Claims 1 and 3-19, all pending claims of the present application, stand rejected and are the subject of the instant Appeal. A copy of each of these claims is attached hereto in the Claims Appendix.

(iv) Status Of Amendments

There are no pending or unentered Amendments. On March 26, 2007, Appellant filed a Response to the Office Action dated December 28, 2006. Applicant made amendments to the claims in the Response to the Office Action of December 28, 2006, which were acknowledged, entered and addressed in the Final Office Action dated June 5, 2007 from which the Appellant now appeals.

(v) Summary Of Claimed Subject Matter

Claims 1, 14, 18 and 19 are the independent claims.

Independent Claim 1

Claim 1 is directed toward a device for depositing crystalline layers on a crystalline substrate. (Abstract; Par. 2) The device includes a high-frequency-heated substrate holder heated by electrical conduction. (Abstract; Pars. 15, 16 & 20) The substrate holder is made from a conductive material and holds a substrate with surface-to-surface contact. (Abstract; Pars. 2 & 20-21) The substrate holder is provided with a first zone and a second zone, the first zone formed of a material having a higher electrical conductivity than the second zone, the first zone having a surface temperature (t_1) and the second zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2. (Abstract; Pars. 2, 7, 16 & 22; FIGS. 2-4) Additionally, the first zone of higher electrical conductivity substantially corresponds to an area of the supported surface of the substrate. (Abstract; Pars. 2 & 7; FIGS. 2-4)

Independent Claim 14

Claim 14 is directed toward a device for depositing crystalline layers on a substrate that comprises a substrate holder for holding a substrate. (Abstract; Par. 2) The device further includes a high-frequency heater heating the substrate holder by electrical conduction to heat the substrate. (Abstract; Pars. 15, 16 & 20) The device also includes a first substrate holder zone formed of a material exhibiting a first electrical conductivity and having a surface temperature (t_1) when the substrate holder is heated by electrical conduction. (Abstract; Pars. 2, 7, 15, 16, 20 & 22; FIGS. 2-4) The device still further includes a second substrate holder zone formed of a material exhibiting a second electrical conductivity, the first electrical conductivity being higher than the second electrical conductivity, the second substrate holder zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2. (Abstract; Pars. 2, 7, 15, 16, 20 & 22; FIGS. 2-4) The device is provided such that the first substrate holder zone directly contacts the substrate where an increased amount of energy is transferred to the substrate from the first substrate holder zone than from the second substrate holder zone, and the first substrate holder zone substantially corresponding to an area taken up by the substrate. (Abstract; Pars. 2, 7 & 16; FIGS. 2-4)

Independent Claim 18

Claim 18 is directed toward a device for depositing crystalline layers on a substrate that comprises a substrate holder having one or more substrate-bearing disks mounted on a gas bearing and each having an associated insert piece. (Abstract; Par. 2, 4, 7, 9 & 17-19; FIG. 1) The device further includes a high-frequency heater heating the substrate holder by electrical conduction to heat the substrate. (Abstract; Pars. 15, 16 & 20) The device also includes a first substrate holder zone substantially corresponding to the insert and formed of a material exhibiting a first electrical conductivity and having a surface temperature (t_1) when the substrate holder is heated by electrical conduction. (Abstract; Pars. 2, 7, 15, 16, 20 & 22; FIGS. 2-4) The device still further includes a second substrate holder zone formed of a material exhibiting a second electrical conductivity, the first electrical conductivity being higher than the second electrical conductivity, the second substrate holder zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2. (Abstract; Pars. 2, 7, 15, 16, 20 & 22; FIGS. 2-4) The device is provided such that the first substrate holder zone directly contacts the substrate where an increased amount of energy is transferred to the substrate from the first substrate holder zone than from the second substrate holder zone. (Abstract; Pars. 2, 7 & 16; FIGS. 2-4)

Independent Claim 19

Claim 19 is directed toward a device for depositing crystalline layers on a substrate that comprises a substrate holder having one or more substrate-bearing disks mounted on a gas bearing and each having an associated insert piece positioned beneath the associated substrate-bearing disk to form a bottom of the bearing recess. (Abstract; Par. 2, 4, 7, 9 & 17-19; FIG. 1) The device further includes a high-frequency heater heating the substrate holder by electrical conduction to heat the substrate. (Abstract; Pars. 15, 16 & 20) The device further includes a first substrate holder zone substantially corresponding to the insert and formed of a material exhibiting a first electrical conductivity and having a surface temperature (t_1) when the substrate holder is heated by electrical conduction. (Abstract; Pars. 2, 7, 15, 16, 20 & 22; FIGS. 2-4) The device also includes a second substrate holder zone formed of a material exhibiting a second electrical conductivity, the first electrical conductivity being higher than the second electrical conductivity, the second substrate holder zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2. (Abstract; Pars. 2, 7, 15, 16, 20 & 22; FIGS. 2-4) The device is provided such that the first substrate holder zone directly contacts the substrate where an increased amount of energy is transferred to the substrate from the first substrate holder zone than from the second substrate holder zone. (Abstract; Pars. 2, 7 & 16; FIGS. 2-4)

(vi) Grounds Of Rejection To Be Reviewed On Appeal

Claims 1, 3, 8, 10, 11, 14 and 17-19 stand rejected under 35 U.S.C. §102(b), as anticipated by U.S. Patent Application Publication No. 2001/0052324 (Rupp et al. application) or in the alternative under 35 U.S.C. §103(a) as unpatentable over the Rupp et al. application.

Claims 9 and 12 stand rejected under 35 U.S.C. §103(a) as being unpatentable over the Rupp et al. application.

Claims 1, 8, 10, 11, 14 and 17-19 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,740,167 (Rupp et al. patent) in view of U.S. Patent No. 5,788,777 (Burk, Jr.).

Claims 4-7 and 13 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Burk, Jr. in view of the Rupp et al. patent or the Rupp et al. application.

(vii) Argument

35 U.S.C. §102(b) Rejection

All the pending claims, stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent Application Publication No. 2001/0052324 (Rupp et al. application).

The invention relates to a device for depositing crystalline layer on a substrate. Radiation losses occur at the surface of a substrate holder. Due to manufacturing related inaccuracies and thermal distortion, gaps that have an insulating effect are formed between the substrate and the surface of the substrate holder resulting in the substrate temperature being lower than the surface temperature of the substrate holder in the vicinity of the substrate. (Par. 4) The temperature difference has an adverse effect on the layer growth characteristics. (Par. 5) To address this problem "the substrate is located on a zone of the substrate holder which is hotter than the substrate holder surface surrounding the substrate" where the "configuration makes it possible to compensate for heat transfer losses." (Par. 7) In addition, "this configuration also has the associated advantage that by suitable over-dimensioning of the zones of higher electrical conductivity, it is possible to generate a temperature profile in which the zones of the substrate holder on which the substrates are located are hotter than the surface of the substrate holder surrounding the substrates." (Par. 7)

Accordingly, claim 1 recites "said substrate holder having a first zone and a second zone, said first zone formed of a material having a higher electrical conductivity than the second zone, the first zone having a surface temperature (t_1) and the second zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2." Claims 14, 18 and 19 recite "a first substrate holder zone . . . formed of a material exhibiting a first electrical conductivity and having a surface temperature (t_1) when the substrate holder is heated by electrical conduction" and "a second substrate holder zone formed of a material exhibiting a second electrical conductivity, said first electrical conductivity being higher than the second electrical conductivity, second substrate holder zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2."

The Examiner has submitted that "neither [US 6,740,167 and US 2001/0052324] specifically recites a difference in temperature, the examiner asserts that this temperature variation is inherent" and that "the examiner's position as supported by the specification (page 2 [007]) of the present invention that when a substrate holder comprises two differing zones of electrical conductivity where the zone of higher electrical conductivity is taken up (directly supported by) the substrate and is formed of a metal that zone is ensured to have a hotter temperature than the zone of lower electrical conductivity" and that it "is the materials of construction that drive the temperature variation." (Official Action 6/5/07, p. 2)

Appellant respectfully submits that Rupp et al. application fails to disclose the above-listed limitations. For example, rather than creating a substrate holder having two temperature zones where the first is a higher temperature than the second, Rupp et al. application discloses "as a result the thermal boundary conditions for the environment surrounding the substrate are the same as those for the substrate itself . . . the heat is transferred from the support, i.e. from the susceptor, to the SiC covering and the SiC substrate by radiation with substantially the same thermal coupling. This makes the <u>temperature distribution on the substrate</u> and in its immediate vicinity <u>more homogene-</u>

ous." (Par. 22) (emphasis added) In addition, Rupp et al. application states that "it is necessary for the temperature to be as identical as possible throughout, even in the area surrounding the substrate. In other words, the temperature on the freely accessible surface of the substrate must be the same as on the surface of the covering 5." (Par. 44) Therefore, Rupp et al. application discloses that the "temperature distribution on the substrate" is "homogeneous." Nowhere does Rupp et al. application disclose two differing temperature zones on the substrate according to the pending claims. It is well settled that "a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). In this case, the Rupp et al. application fails to disclose two temperature zones where the temperature of the first exceeds the temperature of the second as recited in all the pending claims and therefore cannot anticipate any of the pending claims.

Claims 18 and 19 further recite "said first substrate holder zone directly contacting the substrate such that an increased amount of energy is transferred to the substrate from said first substrate holder zone than from said second substrate holder zone." Again, Appellant respectfully submits that Rupp et al. application discloses a homogeneous temperature across the substrate and accordingly, there could not be an increased amount of energy transferred. Accordingly, Appellant respectfully submits that Rupp et al. application cannot anticipate claims 18 and 19.

35 U.S.C. §103(a) Rejections

Rupp et al. application

Appellant further respectfully submits that Rupp et al. application fails to teach "said substrate holder having a first zone and a second zone, said first zone formed of a material having a higher electrical conductivity than the second zone, the first zone having a surface temperature (t_1) and the second zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2" as recited in claim 1. Additionally, Rupp et al. application fails to teach "a first substrate holder zone . . . formed of a material exhibiting a first electrical conductivity and having a surface temperature (t_1) when the substrate holder is heated by electrical conduction" and "a second substrate holder zone formed of a material exhibiting a second electrical conductivity, said first electrical conductivity being higher than the second electrical conductivity, second substrate holder zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2" as recited in claims 14, 18 and 19. In fact, Rupp et al. application teaches away from these limitations stating that "it is necessary for the temperature to be as <u>identical as possible throughout, even in the area surrounding the substrate</u>. In other words, the temperature on the freely accessible surface of the substrate must be the same as on the surface of the covering 5." (Par. 44) (emphasis added) Accordingly, not only does Rupp et al. application not teach these limitations, it actually directly teaches away from two temperature zones and as such, cannot render the pending claims obvious. MPEP 2143.01; *In re Gordon*, 733 F.2d 900, 221 USPQ2d 1125 (Fed. Cir. 1984) (If the proposed modification would render the prior art invention being modified *unsatisfactory for its intended purpose*, then there is no suggestion or motivation to make the proposed modification.)

Accordingly, Appellant respectfully submits Rupp et al. application cannot render any of the pending claims obvious either alone or in combination with another reference as Rupp et al. application directly rejects forming two temperature zones having differing temperatures.

<u>Rupp et al. patent</u>

Appellant respectfully submits that Rupp et al. patent fails to teach two zones where the temperature of the first zone is higher than the temperature of the second zone. The Examiner has submitted that Rupp et al. patent teaches "an insert (zone) made of a metal carbide layer and a susceptor 1 (made of graphite an electrically and thermally conductive material). The wafer is supported in surface to surface contact with the insert such that it substantially corresponds to the supported surface of the substrate." (Official Action 6/5/07, p. 7) Appellant respectfully disagrees.

Appellant respectfully submits that the susceptor is the entire frame which holds all the parts and pieces of the device together and should not properly be construed as a substrate holder as no portion of the susceptor contacts the substrate but rather it is the overall structure that supports the substrate holder (the insert 2). (*See e.g.*, FIGS. 1 & 3) In fact, the susceptor is a separate and apart from the insert. (See, Col. 4, lns. 60-64. The substrate never comes in contact with or is associated with the susceptor.

Additionally, the insert does not have a first and a second temperature zone that are different from each other, but rather Rupp et al. patent teaches that the insert is "composed of a temperature stable carbide." (Col. 5, lns. 7-8) There is absolutely no teaching in Rupp et al. patent to form a substrate holder having two temperature zones that differ from each other, and in fact, Rupp et al. patent suggests that the insert presents a uniform temperature profile. (*See*, Col. 5, lns. 9-15 & 29-34)

Accordingly, Appellant respectfully submits that Rupp et al. patent fails to teach and, in fact, teaches away from a substrate holder having a first zone and a second zone where the first zone has a surface temperature (t_1) that is higher than a surface temperature (t_2) of the second zone as recited in all of the pending claims.

<u>Burk, Jr.</u>

Appellant notes that the Examiner has merely cited the Burk, Jr. for teaching how a holder may be heated. (Official Action 6/5/07, p. 7) Accordingly, Appellant respectfully submits that Burk, Jr. fails to teach a substrate holder having a first zone and a second zone where the first zone has a surface temperature (t_1) that is higher than a surface temperature (t_2) of the second zone as recited in all of the pending claims.

The Examiner has further submitted that "the motivation to provide the susceptor of Rupp et al. '167 with the heater 28 [of Burk, Jr.] is to ensure that the substrate can maintain the required process temperature." (Official Action 6/5/07, p. 7) However, the Examiner provides no support to back up the assertion that the heating system taught in Rupp et al. patent is somehow deficient such that it cannot ensure a required process temperature. Rather, Appellant submits that the Examiner is inappropriately using the pending application as a roadmap to pick and choose various features from the prior art to formulate an obvious rejection.

Accordingly, Appellant respectfully submits that no combination of the Burk Jr. with Rupp et al. patent can render the pending claims obvious and, in fact, the combination of Rupp et al. patent with Burk Jr. is inappropriate.

Appellant additionally notes that it appears that the Examiner is citing portions of Appellant's own specification to support that assertion that two zones of differing electrical conductivity with necessarily having differing temperatures. Appellant disagrees as there are many variables that come into play to determine temperature characteristics and that electrical conductivity is not dispositive but merely one element to consider in the calculation. While the Examiners overbroad statements may have merit where no additional variables come into play, however, in reality many variables need to be considered including, for example but not limited to, the interaction of gases, movement of the substrate, movement of the substrate holder, the flow of the gases, the type of heater used and so forth. Therefore, the simple statement that differing materials with differing electrical conductivities will necessarily have differing temperatures is inaccurate. The fact remains that none of the cited references teach or disclose a substrate holder having a first zone and a second zone where the first zone has a surface temperature (t_1) that is higher than a surface temperature (t_2) of the second zone as recited in all of the pending claims.

Conclusion

For the foregoing reasons, Applicant respectfully submits that the claimed invention embodied in each of claims 1 and 3-19 is patentable over the cited prior art. As such, Applicant respectfully requests that the rejections of each of claims 1 and 3-19 be reversed and the Examiner be directed to issue a Notice of Allowance allowing each of claims 1 and 3-19.

Respectfully submitted,

October 1, 2007

/ Wesley W. Whitmyer, Jr./

Wesley W. Whitmyer, Jr., Registration No. 33,558
Steven B. Simonis, Registration No. 54,449
Attorneys for Applicant
ST. ONGE STEWARD JOHNSTON & REENS LLC
986 Bedford Street
Stamford, CT 06905-5619
Tel. 203 324-6155

Claims Appendix
to Appeal Brief Under 37 CFR §41.37
Serial No. 10/751,390

1. (previously presented) Device for depositing in particular crystalline layers on an in particular crystalline substrate, having:

a high-frequency-heated substrate holder heated by electrical conduction and made from conductive material holding a substrate with surface-to-surface contact,

said substrate holder having a first zone and a second zone, said first zone formed of a material having a higher electrical conductivity than the second zone, the first zone having a surface temperature (t_1) and the second zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2,

characterized in that the first zone of higher electrical conductivity substantially corresponds to an area of the supported surface of the substrate.

2. (cancelled)

3. (previously presented) Device according to claim 1, characterized in that the zone is formed by an insert piece made from metal in a substrate holder which consists in particular of coated graphite.

4. (previously presented) Device according to claim 1, characterized in that the substrate holder has one or more substrate-bearing disks, which are in particular mounted on a gas bearing and each have an associated insert piece.

5. (previously presented) Device according to claim 1, characterized in that the insert piece is directly associated with the substrate bearing disk and in particular the entire substrate bearing disk consists of metal.

6. (previously presented) Device according to claim 1, characterized by a multiplicity of substrate bearing disks disposed in planetary fashion on a substrate holder.

7. (previously presented) Device according to claim 1, characterized in that the substrate bearing disk is located on a gas bearing in a bearing recess in the substrate holder and the insert piece or the more electrically conductive zone is associated with the base of the bearing recess.

8. (previously presented) Device according to claim 1, characterized in that the one or more insert pieces consist of molybdenum, tantalum, tungsten or the like.

9. (previously presented) Device according to claim 1, characterized in that the substrate holder is surrounded by an HF coil.

10. (previously presented) Device according to claim 1, characterized in that the substrate holder is disposed above an HF coil.

11. (previously presented) Device according to claim 1, characterized in that the reactor, with which the substrate holder is associated, is a cold-wall reactor, the walls of which are heated only by the radiation of the heated substrate holder.

12. (previously presented) Device according to claim 1, characterized in that the reactor is a tunnel reactor.

13. (previously presented) Device according to claim 1, characterized in that the reactor is a planetary reactor with a central gas feed and a rotating substrate holder, which is support for a multiplicity of substrate bearing disks arranged in planetary fashion with respect to the center of the substrate holder, which substrate bearing disks in each case rotate on a gas bearing.

14. (previously presented) A device for depositing crystalline layers on a substrate comprising:

a substrate holder for holding a substrate therein;

a high-frequency heater heating said substrate holder by electrical conduction to thereby heat the substrate;

a first substrate holder zone formed of a material exhibiting a first electrical conductivity and having a surface temperature (t_1) when the substrate holder is heated by electrical conduction;

a second substrate holder zone formed of a material exhibiting a second electrical conductivity, said first electrical conductivity being higher than the second electrical conductivity, second substrate holder zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2;

said first substrate holder zone directly contacting the substrate such that an increased amount of energy is transferred to the substrate from said first substrate holder zone than from said second substrate holder zone;

said first substrate holder zone substantially corresponding to an area taken up by the substrate.

15. (previously presented) The device according to claim 14, wherein said first zone comprises a piece formed from a metal that is insertable into said substrate holder.

16. (previously presented) The device according to claim 15, wherein said piece comprises coated graphite.

17. (previously presented) The device according to claim 1, wherein said piece is selected from the group consisting of: molybdenum, tantalum, tungsten and combinations thereof.

18. (previously presented) A device for depositing crystalline layers on a substrate comprising:

a substrate holder having one or more substrate-bearing disks mounted on a gas bearing and each having an associated insert piece;

a high-frequency heater heating said substrate holder by electrical conduction to thereby heat the substrate;

a first substrate holder zone substantially corresponding to the insert and formed of a material exhibiting a first electrical conductivity and having a surface temperature (t_1) when the substrate holder is heated by electrical conduction; and

a second substrate holder zone formed of a material exhibiting a second electrical conductivity, said first electrical conductivity being higher than the second electrical conductivity, second substrate holder zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2;

said first substrate holder zone directly contacting the substrate such that an increased amount of energy is transferred to the substrate from said first substrate holder zone than from said second substrate holder zone.

19. (previously presented) A device for depositing crystalline layers on a substrate comprising:

a substrate holder having one or more substrate-bearing disks mounted on a gas bearing and each having an associated insert piece positioned beneath the associated substrate-bearing disk to form a bottom of the bearing recess;

a high-frequency heater heating said substrate holder by electrical conduction to thereby heat the substrate;

a first substrate holder zone substantially corresponding to the insert and formed of a material exhibiting a first electrical conductivity and having a surface temperature (t_1) when the substrate holder is heated by electrical conduction; and a second substrate holder zone formed of a material exhibiting a second electrical conductivity, said first electrical conductivity being higher than the second electrical conductivity, second substrate holder zone having a surface temperature (t_2) when the substrate holder is heated by electrical conduction, where t_1 is greater than t_2;

said first substrate holder zone directly contacting the substrate such that an increased amount of energy is transferred to the substrate from said first substrate holder zone than from said second substrate holder zone.

Evidence Appendix
to Appeal Brief Under 37 CFR §41.37
Serial No. 10/751,390

No evidence of any kind, including evidence submitted under 37 CFR 1.130, 1.131 or 1.132, has been entered by the Examiner and relied upon by Appellant in the appeal.